

§ 18.24

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**§ 18.24 Electrical clearances.**

Minimum clearances between uninsulated electrical conductor surfaces, or between uninsulated conductor surfaces and grounded metal surfaces, within the enclosure shall be as follows:

MINIMUM CLEARANCES BETWEEN UNINSULATED SURFACES

Phase-to-Phase Voltage (rms)	Clearances (inches)	
	Phase-to-Phase	Phase-to-Ground or Control Circuit
0 to 250 .....	0.25	0.25
251 to 600 .....	0.28	0.25
601 to 1000 .....	0.61	0.25
1001 to 2400 .....	1.4	0.6
2401 to 4160 .....	3.0	1.4

[57 FR 61209, Dec. 23, 1992]

**§ 18.25 Combustible gases from insulating material.**

(a) Insulating materials that give off flammable or explosive gases when decomposed electrically shall not be used within enclosures where the materials are subjected to destructive electrical action.

(b) Parts coated or impregnated with insulating materials shall be heat-treated to remove any combustible solvent(s) before assembly in an explosion-proof enclosure. Air-drying insulating materials are excepted.

**§ 18.26 Static electricity.**

Nonmetallic rotating parts, such as belts and fans, shall be provided with a means to prevent an accumulation of static electricity.

**§ 18.27 Gaskets.**

A gasket(s) shall not be used between any two surfaces forming a flame-arresting path except as follows:

(a) A gasket of lead, elastomer, or equivalent will be acceptable provided the gasket does not interfere with an acceptable metal-to-metal joint.

(b) A lead gasket(s) or equivalent will be acceptable between glass and a hard metal to form all or a part of a flame-arresting path.

**§ 18.28 Devices for pressure relief, ventilation, or drainage.**

(a) Devices for installation on explosion-proof enclosures to relieve pressure, ventilate, or drain will be acceptable provided the length of the flame-arresting path and the clearances or size of holes in perforated metal will prevent discharge of flame in explosion tests.

(b) Devices for pressure relief, ventilation, or drainage shall be constructed of materials that resist corrosion and distortion, and be so designed that they can be cleaned readily. Provision shall be made for secure attachment of such devices.

(c) Devices for pressure relief, ventilation, or drainage will be acceptable for application only on enclosures with which they are explosion tested.

**§ 18.29 Access openings and covers, including unused lead-entrance holes.**

(a) Access openings in explosion-proof enclosures will be permitted only where necessary for maintenance of internal parts such as motor brushes and fuses.

(b) Covers for access openings shall meet the same requirements as any other part of an enclosure except that threaded covers shall be secured against loosening, preferably with screws having heads requiring a special tool. (See Figure 1 in Appendix II.)

(c) Holes in enclosures that are provided for lead entrances but which are not in use shall be closed with metal plugs secured by spot welding, brazing, or equivalent. (See Figure 10 in Appendix II.)

**§ 18.30 Windows and lenses.**

(a) MSHA may waive testing of materials for windows or lenses except headlight lenses. When tested, material for windows or lenses shall meet the test requirements prescribed in § 18.66 and shall be sealed in place or provided with flange joints in accordance with § 18.31.

(b) Windows or lenses shall be protected from mechanical damage by structural design, location, or guarding. Windows or lenses, other than headlight lenses, having an exposed area greater than 8 square inches, shall

be provided with guarding or equivalent.

**§ 18.31 Enclosures—joints and fastenings.**

(a) Explosion-proof enclosures:

(1) Cast or welded enclosures shall be designed to withstand a minimum internal pressure of 150 pounds per square inch (gage). Castings shall be free from blowholes.

(2) Welded joints forming an enclosure shall have continuous gas-tight welds. All welds shall be made in accordance with American Welding Society standards.

(3) External rotating parts shall not be constructed of aluminum alloys containing more than 0.6 percent magnesium.

(4) MSHA reserves the right to require the applicant to conduct static-pressure tests on each enclosure when MSHA determines that the particular

design will not permit complete visual inspection or when the joint(s) forming an enclosure is welded on one side only (see § 18.67).

(5) Threaded covers and mating parts shall be designed with Class 1A and 1B (coarse, loose-fitting) threads. The flame-arresting path of threaded joints shall conform to the requirements of paragraph (a)(6) of this section.

(6) Enclosure requirements shall be based on the internal volumes of the empty enclosure. The internal volume is the volume remaining after deducting the volume of any part that is essential in maintaining the explosion-proof integrity of the enclosure or necessary for the operation. Essential parts include the parts that constitute the flame-arresting path and those necessary to secure parts that constitute a flame-arresting path. Enclosures shall meet the following requirements:

EXPLOSION-PROOF REQUIREMENTS BASED ON VOLUME

	Volume of empty enclosure		
	Less than 45 cu. in.	45 to 124 cu. in. inclusive	More than 124 cu. in.
Minimum thickness of material for walls <sup>1</sup> .....	1/8"	3/16"	1/4"
Minimum thickness of material for flanges and covers .....	2 1/4"	3 3/8"	3 1/2"
Minimum width of joint; all in one plane <sup>4</sup> .....	1/2"	3/4"	1"
Maximum clearance; joint all in one plane .....	0.002"	0.003"	0.004"
Minimum width of joint, portions of which are in different planes; cylinders or equivalent <sup>4,5</sup> .....	3/8"	5/8"	3/4"
Maximum clearances; joint in two or more planes, cylinders or equivalent:			
(a) Portion perpendicular to plane <sup>6</sup> .....	0.008"	0.008"	0.008"
(b) Plane portion .....	0.006"	0.006"	0.006"
Maximum bolt <sup>7,8</sup> spacing; joints all in one plane .....	( <sup>16</sup> )	( <sup>16</sup> )	( <sup>16</sup> )
Maximum bolt spacing; joints, portions of which are in different planes .....	( <sup>9</sup> )	( <sup>9</sup> )	( <sup>9</sup> )
Minimum diameter of bolt (without regard to type of joint) .....	1/4"	1/4"	3/8"
Minimum thread engagement <sup>10</sup> .....	1/4"	1/4"	3/8"
Maximum diametrical clearance between bolt body and unthreaded holes through which it passes <sup>8,11,12</sup> .....	1/64"	1/32"	1/16"
Minimum distance from interior of enclosure to the edge of a bolt hole: <sup>8,13</sup>			
Joint—minimum width 1" .....			14 7/16"
Joint—less than 1" wide .....	1/8"	3/16"	
Cylindrical joints			
Shaft centered by ball or roller bearings:			
Minimum length of flame-arresting path .....	1/2"	3/4"	1"
Maximum diametrical clearance .....	0.020"	0.025"	0.030"
Other cylindrical joints: <sup>15</sup>			
Minimum length of flame-arresting path .....	1/2"	3/4"	1"
Maximum diametrical clearance .....	0.006"	0.008"	0.010"

<sup>1</sup> This is the minimal nominal dimension when applied to standard steel plate.

<sup>2</sup> 1/32 inch less is allowable for machining rolled plate.

<sup>3</sup> 1/16 inch less is allowable for machining rolled plate.

<sup>4</sup> The widths of any grooves, such as grooves for holding oil seals or O-rings, shall be deducted in measuring the widths of flame-arresting paths.

<sup>5</sup> If only two planes are involved, neither portion of a joint shall be less than 1/8 inch wide, unless the wider portion conforms to the same requirements as those for a joint that is all in one plane. If more than two planes are involved (as in labyrinths or tongue-and-groove joints) the combined lengths of those portions having prescribed clearances are considered.

<sup>6</sup> The allowable diametrical clearance is 0.008 inch when the portion perpendicular to the plane portion is 1/4 inch or greater in length. If the perpendicular portion is more than 1/8 inch but less than 1/4 inch wide, the diametrical clearance shall not exceed 0.006 inch.